

Claims

[c1] What is claimed is:

1. A lithography method for forming a plurality of closed patterns in a photoresist layer on a substrate, the patterns being isolated from each other and being arranged in an array, the lithography method comprising:
providing a phase shift mask (PSM), wherein the phase shift mask comprises:
a plurality of first phase shift transparent regions;
a plurality of second phase shift transparent regions having a phase shift relative to the first phase shift transparent regions; and
a non-phase shift region, wherein the first phase shift transparent regions and the second phase shift transparent regions are regularly interlaced in an array, and each of the first phase shift transparent regions and each of the second phase shift transparent regions are separated by the non-phase shift region; and
performing an exposure process to form the closed patterns in the photoresist layer, wherein the closed patterns are corresponding to the first phase shift transparent regions and the second phase shift transparent regions.

- [c2] 2.The lithography method of claim 1 wherein the substrate is selected from the group consisting of a semiconductor wafer, a glass substrate, a polymer substrate, and a quartz substrate.
- [c3] 3.The lithography method of claim 1 wherein the photoresist layer is a positive photoresist layer.
- [c4] 4.The lithography method of claim 1 wherein the closed pattern is selected from the group consisting of a contact hole pattern and a logic cell pattern of a logic circuit.
- [c5] 5.The lithography method of claim 1 wherein the phase shift mask is an alternate phase shift mask (altPSM).
- [c6] 6.The lithography method of claim 5 wherein the first phase shift transparent regions have a phase shift of 180 degrees relative to the second phase shift transparent regions.
- [c7] 7.The lithography method of claim 1 wherein the non-phase shift region is an opaque region, and the non-phase shift region is formed from a chrome film.
- [c8] 8.The lithography method of claim 1 wherein the non-phase shift region is a not completely transparent region, and a transmittance of the non-phase shift region

is selected from the group consisting of 6%, 9%, 18%, and 20%.

- [c9] 9. A lithography method for forming a plurality of closed patterns in a photoresist layer on a substrate, the patterns being isolated from each other and being arranged in an array, the lithography method comprising:
- providing a phase shift mask (PSM), wherein the phase shift mask comprises:
 - a plurality of first phase shift transparent regions;
 - a plurality of second phase shift transparent regions having a phase shift relative to the first phase shift transparent regions; and
 - a non-phase shift region, wherein portions of the first phase shift transparent regions and portions of the second phase shift transparent regions are regularly interlaced in an array, and each of the first phase shift transparent regions and each of the second phase shift transparent regions are separated by the non-phase shift region; and
 - performing an exposure process to form the closed patterns in the photoresist layer, wherein the closed patterns are corresponding to the first phase shift transparent regions and the second phase shift transparent regions.

- [c10] 10.The lithography method of claim 9 wherein the substrate is selected from the group consisting of a semiconductor wafer, a glass substrate, a polymer substrate, and a quartz substrate.
- [c11] 11.The lithography method of claim 9 wherein the photoresist layer is a positive photoresist layer.
- [c12] 12.The lithography method of claim 9 wherein the closed pattern is selected from the group consisting of a contact hole pattern and a logic cell pattern of a logic circuit.
- [c13] 13.The lithography method of claim 9 wherein the phase shift mask is an alternate phase shift mask (altPSM).
- [c14] 14.The lithography method of claim 13 wherein the first phase shift transparent regions have a phase shift of 180 degrees relative to the second phase shift transparent regions.
- [c15] 15.The lithography method of claim 9 wherein the non-phase shift region is an opaque region, and the non-phase shift region is formed from a chrome film.
- [c16] 16.The lithography method of claim 9 wherein the non-phase shift region is a not completely transparent region, and a transmittance of the non-phase shift region

is selected from the group consisting of 6%, 9%, 18%, and 20%.